# DESIGN STANDARDS

# DESIGN STANDARDS 7/28/04

## CIVIL / ENVIRONMENTAL

### NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

- Director's Order #83 - Public Health

### LAWS

- Individual State Regulatory Agency regulations governing storm water management
- Federal Water Pollution Control Act and amendments
- Safe Drinking Water Act and amendments
- Surface Water Treatment Rule

### CODES AND STANDARDS

**Site Design**

- Applicable AASHTO Design Guidelines
- AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing - Parts I and II
- Asphalt Institute standards
- Portland Cement Association standards

**Water / Wastewater**

- Individual State Regulatory Agency regulations for water and wastewater
- EPA Federal regulations
- AWWA standards
- ASTM standards
- ANSI standards
- NSF International standards
- NACE standards
- 10-state standards for wastewater projects
- Underwriters Laboratories, Inc., standards

**Hazmat**

- Resource Conservation and Recovery Act
- Comprehensive Environmental Response, Compensation and Liability Act
- Hazard Communication Ruling (part of OSHA, 29 CFR 1910.1200)
- Hazardous Waste Operations and Emergency Response
- EPA hazmat regulations
  - Clean Air Act (CAA), National Emission Standards for Hazardous Air Pollutants
  - Asbestos Hazard Emergency Response Act
  - 40 CFR Protection of Environment
- Individual State regulations
- ASTM (Phase I and II Environmental Site Assessments)
- NFPA
- NACE
- American Petroleum Institute
- UL

### QUALITY REQUIREMENTS

## LANDSCAPE ARCHITECTURE

### NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

- Director's Order 2, Park Planning, Chapter 2 of Management Policies, Park System Planning, and Planner's Source Book
- Director's Order 12, Environmental Impact Analysis
- Director's Order 17, Tourism
- Director's Order 28, Cultural Resource Management
- Director's Order 42, Accessibility for Park Visitors
- Director's Order 52C, Park Signs
- Director's Order 87A, Park Roads and Parkways
- Director's Order 87B, Alternative Transportation Systems
- Director's Order 87D, Non-NPS Roads Transportation
- The Secretary of the Interior's Standards for the Treatment of Historic Properties, 1995
- UniGuide - Identification Wayfinding And Visitor Information For National Parks (.pdf file), U.S. Department of Interior - National Park Service

### LAWS

- Americans with Disabilities Act (ADA) (See US Access Board for reference materials for ADA compliance)
- Transportation Equity Act for the 21st Century (TEA-21)

### CODES AND STANDARDS

### QUALITY REQUIREMENTS

- Park General Management Plan, EIS, EA,.
- Special Regulations for Areas of the National Park System
- Uniform Federal Accessibility Standards (UFAS), 1984
- Guiding Principles of Sustainable Design
- Greening Federal Facilities, An Energy, Environmental, and Economic Resource Guide for Federal Facility Managers and Designers
- Park Road Standards (1984) (PDF format, 11MB)
- Park Roads and Parkways (NPS Intranet Site)
- Alternative Transportation Systems Guidebook
- Alternative Transportation Web Site
- Manual on Uniform Traffic Control Devices (MUTCD), 1988 Edition U.S. Department of Transportation - Federal Highway Administration
- Federal Lands Highway, Project Development and Design Manual, U.S. Department of Transportation - Federal Highway Administration

- Federal Lands Highway Construction Manual, U.S. Department of Transportation - Federal Highway Administration
- Flexibility in Highway Design, U.S. Department of Transportation Officials - Federal Highway Administration
- Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, U.S. Department Of Transportation - Federal Highway Administration
- Part 2, Designing Sidewalks and Trails for Access, U.S. Department of Transportation - Federal Highway Administration
- Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials
- Transportation Planning Guidebook, U.S. Department of Interior - National Park Service
- National Scenic Byways Guide, May 2002
- Inventory and Assessment of NPS Visitor Transportation Systems - Final Report - August 1999

## ARCHITECTURAL

### NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

- **The Secretary of the Interior's Standards for the Treatment of Historic Properties, 1995**
- **Director's Order (DO) 28, Cultural Resource Management**
- **RM 50B, Occupational Safety and Health Program, Section 12, "Fire Safety"**
- **Director's Order (DO) 58, Structural Fire Management**
- **Director's Order (DO) 89, Acquisition and Management of Leased Space**
- **Director's Order 90, Value Analysis**
- **Guiding Principals of Sustainable Design**

### LAWS

- Americans with Disabilities Act (ADA) (See US Access Board for reference materials for ADA compliance)
- National Historic Preservation Act of 1966 (Section 106)
- Executive Order 13123 " - Greening of Federal Facilities"
- **41 CFR 101-17 Assignment and Utilization of Space**

### CODES AND STANDARDS

- **International Building Code (IBC), 2003**
- **Uniform Federal Accessibility Standards (UFAS), 1984**
- **NPS Architectural Drafting Requirements**
- **DSC Quality Assurance Guidelines**
- **DSC Design Document Standards**

### QUALITY REQUIREMENTS

**General:**

- Meet all requirements as stated in the Architectural Quality Assurance Guidelines.
- Do not use "Federal Specification Numbers" as they are obsolete.

**Sustainability:**

- A set of Federal Laws, Executive Orders, and Executive Memoranda direct Federal Government facility managers to reduce the energy and environmental impacts of the buildings they manage. Based on these, sustainable design practices should be incorporated into each project.
- "LEED" rating system version 2.1 should be used to establish sustainable goals for each project
- "LEED" scorecard should be used to evaluate and score projects as a requirement of the Development Advisory Board review process
- Review current federal regulations Executive Order 13123 " - Greening of Federal Facilities"
    - See DSC document - "Guiding Principals of Sustainable Design"
    - See resource guide - "Greening Federal Facilities / Second Edition"

**Specific Products and Materials:**

Division 3 – Concrete

- Consider sustainable practices such as using fly ash in concrete mixture where appropriate to reduce cement content

Division 4 – Masonry

- Consider "life-cycle assessment" when selecting masonry products

Division 5 – Metals

- Avoid using "COR-TEN Steel" products on buildings. Runoff from this product stains surfaces when coming in contact and adds pollutants to soils and ground water.

Division 6 – Wood and Plastics

- For sustainability, consider using "Certified Forest Products" as designated by the Forest Stewardship Council, if appropriate for project and cost effective.

- If appropriate for project and cost effective, consider using agro board / bio products for interior fiberboard/plywood products applications (particleboard made from renewable products such as wheat, straw, sunflower hulls, etc.)

- If appropriate for project and cost effective, consider recycled plastic products for interior applications such as countertops.

Division 7 - Thermal and Moisture Protection

- See Roofing/Waterproofing Standards as part of this document

Division 8 - Doors and Windows

- Door and window selection should be based on improved thermal performance.
- Verify with park when selecting architectural hardware. As a standard in most NPS parks, all keyed locks in a project should be keyed to the "Best" lock system.
- Glazing for each building elevations should be selected based on building orientation and improved thermal performance

Division 9 – Finishes

- Select products that require low maintenance and are durable.
- If appropriate and cost effective, consider using “Green” products when selecting products.

Division 10 – Specialties

- Select products that require  low maintenance and are durable (ie. toilet partitions)
- Toilet accessories to match existing manufacture used in park
- Signage system shall comply with NPS and individual park sign standards and by appropriate for the park setting. See NPS sign directive and standards. (create link)
- All communication (telephone, radio, alarms) systems must be coordinated with the park staff

Division 11 – Equipment

- Verify with park the need for any specialized equipment

Division 12 – Furnishings

- If appropriate, consider using “Green” products when selecting furnishings.
- Consider using door mats at all main or key entrances for improved indoor air quality

Division 13 – Special Construction

- If appropriate and cost effective, consider Solar/ Wind Turbine Systems for power generation.
- If appropriate and cost effective, consider Building Automation System (Energy Management System) for efficient energy monitoring.

Division 14 – Conveying Systems

- All Federal facilities must comply with ADA.  The use of elevators or wheelchair/stair lifts may be required for some facilities.

- If appropriate and cost effective, consider using vegetable-based hydraulic fluid elevator system

- Hoist or cranes may be required for some maintenance facilities.  Avoid designing open work pits in maintenance facilities due to safety hazard.

## ROOFING / WATERPROOFING

### CODES AND STANDARDS

- IBC (International Building Code) 2003
- IPC (International Building Code) 2003
- ASCE 7

### QUALITY REQUIREMENTS

- National Roofing Contractors Association – Roofing and Waterproofing Manual
- Factory Mutual Global
- Underwriters Laboratories
- Wind load as calculated using ASCE 7
- Determination of fire rated roof Classification
- Roof drainage as calculated using IPC or other established sources
- Determine dew point location in roof assembly and vapor barrier needs

**Single–Ply Membrane Roofs**

- Specify roofing products, all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the warranty period.
- Specify a 20 year system and require a 15-year System Roofing Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.
- Specify PVC (60 mil minimum thickness) and EIP (45 mil minimum thickness) systems to be mechanically attached or fully adhered when roof membrane is visible from ground.
- EPDM systems shall be fully adhered 60 mil thickness, using 7" wide tape seams, and be warranted for 20 years.
- Specify single-ply roof system when foot traffic is minimal, roof shape is complex or when numerous roof penetrations are present.
- Specify a dense, fire and water resistance cover board made from gypsum or other man made materials to be placed over the deck or insulation board
- Specify a pre-manufactured 2-piece counterflashing; coping system; and roof edge/fascia system
- Minimum roof pitch of ¼"/ft and 1/8"/ft along valleys

**SBS Modified Bitumen Roofs**

- Specify 2-ply system where roofing products, including each type of sheet, are all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the specified warranty period.
- Specify a 20 year system and require a 15-year System Roofing Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.
- APA systems are not permitted
- Specify SBS roof systems where high puncture resistance, exposure to abuse or frequent access is needed on the roof to maintain mechanical equipment.
- Specify torch down and adhesive systems, avoid hot mop asphalt.
- Specify a dense, fire and water resistance cover board made from gypsum or other man made materials to be placed over the deck or insulation board
- Specify a pre-manufactured 2-piece counterflashing; coping system; and roof edge/fascia system
- Minimum roof pitch of ¼"/ft and 1/8"/ft along valleys

**Asphalt Shingles Roofs**

- Specify a 2-ply laminated shingle, conforming to ASTM D3462, with a minimum 50-year material warranty and a minimum 15-year non-prorated labor and material watertightness warranty (i.e. Certainteed-Sure Start Plus 5 Star, GAF-Golden Pledge, Malarkey-steep slope system, etc.)
- In humid and wet climates, specify algae resistant shingles
- In hailstorm areas, specify impact resistance shingles passing an UL 2218 test for Class 3 or 4.
- In high wind areas, (greater than 90 mph) specify wind resistant shingles rating to wind speed determined by ASCE 7, and require a 10-year wind warranty
- In snow/ice climates, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.

- Fasten shingles with minimum12 gauge corrosion resistant nails only. Minimum nail head diameter shall be 3/8". Shank shall penetrate minimum of ¾" in wood decking or completely through plywood decking.
- Asphalt-saturated felt underlayment shall meet ASTM D 226 and/or D 4869. Use double layers on roof slopes less than 4:12.
- Specify roof perimeter edge metal and step flashing at walls and chimneys.
- Minimum slope 3:12.
- Specify open, closed, or woven valleys

**Metal Roofs**

- Specify metal roof manufacturers who offer Full System Manufacturer's Roofing Warranty for 20-year labor and material warranty, for the installed cost of roof, to repair leaks in the roof panels, flashing and trim resulting from defects in materials or workmanship. Roof manufacturers shall be required to inspect the work during construction (i.e. AEPS span-weather tightness, Berridge-Total Single Source, MBCJ-single source III, etc.).
- Verify with manufacturer their underlayment requirement for the 20-year warranty
- Steep roof (hydrokinetic) roofs shall pass air and water infiltration tests per ASTM E1646 and E1680. Low slope (hydrostatic) roofs shall pass water infiltration tests per ASTM E2140. Submit test report.
- Specify Kynar 500 or Hylar 5000 paint finish on metal panels which require paint.
- Specify 22 gage galvalume/zincalume and/or galvanized metal roofs. For structures located in coast regions use 0.040" aluminum or 20 oz copper. For high profile structures, use any of the above 3 materials.
- For architectural panel roofs, specify snap type standing or batten seam with continuous length panels. Panel should be kept off substrate by manufacturer's clips. Double lock standing seams should only be used in high snow areas where snow will accumulate on the roof over the winter
- For structural or structural/architectural panel roofs, specify concealed fasteners and clips for panel attachment. No fasteners shall be located in the pan of the panel except at the ridge.
- Panels and trim shall be rolled formed at the manufacturer's prime manufacturing plant
- Specify manufactured prepared shop drawing on a minimum 24" by 36" sheet.
- Metal shingles and shingle panels to be used on steep slope (3:12 or greater). Investigate the bottom, top and side of each shingle to determine the interlocking mechanism and watertightness of the lap, joint and seam. Examine ridge, valley, hip and perimeter flashings profiles for watertightness. These products maybe problematic on roofs that retain snow for long periods of time.
- Specify rosin paper slip sheet under all architectural metal roofs
- In snow/ice climates or as required for warranty, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology when possible.
- Specify self-adhered high temperature underlayment.

**Clay and Concrete Tile Roofs**

- Specify clay tile manufacturers who offer a 20-year labor and material warranty, for the installed cost of roof, to replace defective tiles resulting from defects in materials or workmanship
- Clay Tile shall meet or exceed ASTM C1167 Grade 1 requirements for durability and ASTM C1167 Type I for appearance
- Concrete tile shall meet or exceed ASTM C1492 requirements.
- In freeze/thaw climates specify clay tile manufacturers who have tiles with a moisture absorption rate of less than 1% per ASTM C67. Concrete tile shall have a minimum compressive strength of 7500 psi, shall not have more than 1% loss in dry weight per ASTM C67 and not absorb more than 8% of the dry weight in ASTM C140 immersion test.
- Specify 2 layers of 30# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869.

- In snow/ice climates or as required for warranty, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.
- In hailstorm areas, specify manufacturers who provide a minimum10-year hail warranty covering material replacement of damaged tiles

**Slate Roofs**

- Specify slate tile manufacturers who provide a 75-year material warranty. The installer shall provide a 5-year leak proof warranty for the installed cost of the roof, to replace defective flashings and tiles resulting from defects in materials or workmanship.
- Specify slate manufacturers whose products meet ASTM C406 and can certify their slate to a Grade S1 classification by providing test results which are not more than 3 years old.
- Specify 3/8" minimum thick slate in freeze/thaw, high wind or heavy hail areas, ¼" minimum thick slate in other areas. Avoid slate from Pennsylvania.
- Specify two layers of 30# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869 or one layer of fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment. Use a 3" minimum headlap for roof slopes between 4:12 to 8:12.
- In snow/ice climates, specify fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.
- Specify 10 gage copper slating nails, stainless steel, bronze or cut-brace roof nails and fasten with 2 nails per slate. In high wind areas or when ¾" or thicker slate is used, fasten with 4 nails per slate.
- Provide eave cant for starter course.
- Flashings shall be fabricated from 20 oz copper or 24 gage stainless steel. Open valley pan shall be formed with a "W" or "V" shaped splash diverter.

**Wood Shakes and Shingle Roofs**

- National Parks are slowly transitioning away from wood products as a result of increased fire danger throughout the west, the limited availability of domestic supplied material, and the reduce life expectancy of the product in many parts of the country. However, in some cases historic preservation standards may dictate the use of these products.
- Specify No. 1 premium official blue label western red cedar shingle; premium grade western red cedar shake; or pressure treated No. 1 vertical grain, all clear yellow pine shingle.
- Specify one layer (for shingles) or two layers (for shakes) of 15# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869 or one layer of fully adhered ice and water protection 40 mil minimum butyl-adhesive based underlayment. The second layer of felt is interlaced between courses when installing shakes.
- In snow/ice climates, specify fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormers or other walls. Use cold roof design technology if possible.
- Use a 3 layer starter course for roofs with each course hanging over the lower one by ¼".
- Specify a minimum 4:12 pitch roof, prefer a 5:12 minimum pitch and shingle widths between 3 and 9 inches.
- Specify copper or zinc sheets at ridge in humid climates to reduce moss growth
- Hand nail shakes and shingles. Nail guns and staples are not allowed

**Specialty Roofs**

- Evaluated on a case-by-case basis

**Waterproofing Systems**

- Specify waterproofing products, all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the warranty period.
- Specify a minimum 10-year Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.
- Specify the use of certified contractors to apply the waterproofing system and that the work be inspected by the manufacturer at a minimum of once a week during installation
- Waterproofing below the water table may limit the selection of the waterproofing membrane.
- The type of substrate the waterproofing will be applied to shall be considered before selecting the waterproofing system.

## STRUCTURAL

## NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

## LAWS

## CODES AND STANDARDS

- IBC 2003
- IEBC 2003
- ASCE 7-98
- ACI 318-99
- ACI 301-99
- ACI 530/530.1-02
- AISC ASD 9th edition or LRFD 3rd edition
- AISC Code of Standard Practice for Steel Buildings and Bridges, March 7, 2000
- NDS-97
- AITC Manual 4th edition

## QUALITY REQUIREMENTS

**Load Requirements**

- Floor live Load: IBC 2003
- Roof Live Load: IBC 2003
- Snow Load: as required for building location
- Wind Load: as required for building location
- Seismic: as required for building location
- Vehicle Bridges: HS20
- Pedestrian Bridges and Boardwalks: 85 psf

**Foundations**

- Frost Depth: As required for building location

**Concrete**

- Minimum slab-on-grade thickness, 5"
- Minimum compressive strength at 28 days: 4000 psi
- Reinforcing steel: ASTM A615 Grade 60

**Masonry**

- Concrete masonry minimum f'm: 1500 psi
- Reinforcing Steel: ASTM A615 Grade 60
- Below grade walls and retaining walls grouted solid

**Steel**
- W Shapes: ASTM A992, 50 ksi
- S, M, HP and Channels: ASTM A36 or A572 Grade 50
- Angles and Plates: ASTM A36
- TS or HSS: ASTM A500, Grade B, 46 ksi
- Minimum Fillet Weld Size: 3/16"

**Wood**
- Minimum roof sheathing thickness, 5/8"
- Minimum wall sheathing thickness 1/2"
- Framing Lumber (depending on location and availability)
  - Southern Pine No. 2 or better
  - Hem Fir No.2 or better
  - Douglas Fir Larch No.2 or better
- Provide blocking between roof framing members at bearing locations
- Provide plywood or OSB sheathing over heavy timber decking to create a diaphragm

## MECHANICAL

## NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

## LAWS

## CODES AND STANDARDS

- UPC Uniform Plumbing Code"

**HVAC**
- ANSI/ASHRAE 15-1994, "Safety Code for Mechanical Refrigeration"
- ASHRAE 62-1999, "Ventilation for Acceptable Indoor Air Quality"
- ASHRAE 90.1-1999, "Energy Standard for Buildings Except Low-Rise Residential Buildings"
- ASHRAE 90.2-1993, "Energy-Efficient Design of New Low-Rise Residential Buildings"
- UMC 2003 Uniform Mechanical Code"
- NFPA Codes and Standards
- 1995 SMACNA HVAC Duct Construction Standards

**Plumbing**
- USATB Americans with Disabilities Act Accessibility Guidelines (ADAAG - Barrier-Free Plumbing Fixtures)

**Fuel Systems**
- NFPA Codes and Standards
- API RP 1615-1996, "Installation of Underground Petroleum Storage Systems"

**Stationary Engines and Cogeneration**
- NFPA Codes and Standards

**Conveying Systems**
- ANSI A17.1-1996, "Safety Code for Elevators and Escalators"
- ANSI A17.2-1988, "Inspectors' Manual for Elevators and Escalators"

- ANSI B30.11-1998, "Monorails and Underhung Cranes"
- ANSI B30.16-1998, "Overhead Hoists (Underhung)"
- ANSI A117.1-1986, "Making Buildings and Facilities Accessible and Usable by Physically Handicapped People"
- ANSI/ALI ALCTV-1998, "Safety Requirements for Automotive Lifts - Construction, Testing, and Validation"
- ANSI/ALI ALIS-2001, "Safety Requirements for Installation and Service of Lifts"
- ANSI/MMA MH27.1-1981, "Specifications for Underhung Crane and Monorail Systems"
- CMAA 70-1994, "Specification for Electric Overhead Traveling Cranes"
- CMAA 74-1994, "Specification for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes"
- HMI 100-1974, "Specification for Electric Wire Rope Hoists"

## QUALITY REQUIREMENTS

**Mechanical Drawing Preparation Standards**

- See **Document Standards** and **Drafting Standards**
- **NPS/DSC CAD Model/Paper Space Standard**

**Mechanical Design Requirements and Guidelines**

- HVAC
  - Outdoor Design Conditions: 2001 ASHRAE "Handbook of Fundamentals", Chapter 27 (Climatic Design Information)
  - Building Material Thermal Properties: 2001 ASHRAE "Handbook of Fundamentals", Chapter 25 (Thermal and Water Vapor Transmission Data)
  - Indoor Design Conditions for Public, Office, and Living Spaces:
    - Winter: 72 degrees F
    - Summer: 75 degrees F
    - Maximum Relative Humidity: 60%
  - Indoor Design Conditions for Shop and Storage Spaces:
    - Winter: 65 degrees F
    - Summer: 80 degrees F
  - General Ventilation: In accordance with ASHRAE 62.
  - Restroom Ventilation: Minimum 2 CFM per square foot of floor area.
  - Acoustical Criteria (maximum values):
    - Auditoriums and Exhibit Spaces: NC25
    - Office Spaces: NC35
    - Shop Spaces: NC45
  - Refrigerant Bearing Equipment: All refrigerant bearing equipment shall be CFC-free.
- Plumbing
  - Domestic Water Heating: 1999 ASHRAE "Handbook of Applications", Chapter 48 (Service Water Heating)
  - Compressed Air Systems: 1988 CAGI "Compressed Air and Gas Handbook"
  - Plumbing Fixtures: All plumbing fixtures and fittings shall be low-flow water conserving types, conforming to 1992 Energy Policy Act requirements.
  - Backflow Prevention: Comply with each park's backflow prevention regulations. As minimums, provide double check valve assemblies on all fire services or other water service connections that may produce objectionable backflow and reduced pressure zone backflow assemblies on all makeup water connections to HVAC equipment or other water service connections that may produce hazardous backflow.
  - Metering: All domestic water, reclaimed water, and fuel gas services to each building shall be metered in accordance with NPS Staff Directive 78-10.

- Water Pressure: Pressure reducing valves shall be provided as necessary to limit water pressure in buildings to 80 psig maximum. Booster pumps shall be provided as necessary to maintain a minimum of 25 psig at the furthest plumbing fixture at design flowrate conditions.

## FIRE PROTECTION

## NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

## LAWS

## CODES AND STANDARDS

## QUALITY REQUIREMENTS

- New buildings, buildings undergoing renovation, or buildings with a change in occupancy, shall be provided with automatic sprinkler system protection per NPS Reference Manual 58 (Structural Fire)
- Occupancy Hazards: Occupancy hazards for fire sprinkler system design shall be in accordance with NFPA 13D, 13R, or 13..
- Residential Sprinkler Systems: Residential occupancies shall be provided with fire sprinkler systems conforming to NFPA 13D or NFPA 13R.
- Valve Supervision: Main control valves shall be electrically supervised open.
- Piping: Piping for fire sprinkler systems other than residential shall be Schedule 40 steel pipe. Schedule 10, thinwall, or threadable thinwall piping will not be acceptable. Pipe and fittings for dry pipe systems shall be hot-dip galvanized.
- Dry pipe or anti-freeze systems shall be provided where there is the possibility of freezing.
- Fire pumps or pressure tanks shall be provided as necessary when the available site water pressure is insufficient to meet the calculated sprinkler system hydraulic demand.
- Equivalencies to these requirements shall be developed by a Fire Protection Engineer

**Fire Safety Plan**

**RM 58 requires that all projects develop a Fire Safety Plan to address the unique fire and life safety issues. The Fire Safety Plan consists of the following elements.**

**INTRODUCTION**

**DESIGN TEAM**

**APPLICABLE CODES**

**FIRE PROTECTION/LIFE SAFETY APPROACH**

General Description
General Fire Resistive Construction Aspects
Occupancy Classifications
Fire Resistive Separations
Doors and Windows
Interior Wall, Ceiling and Floor Finishes
Decorative Structures within Buildings
Egress
Special Design
Emergency Signage
Suppression Systems
Fire Department Access
Fire Detection and Alarm System
Emergency Communication Systems

Smoke Management Description
Central Control Station
Emergency and Standby Power
Elevators
ACCEPTANCE TESTING
PERIODIC OPERATION AND MAINTENANCE
CONCLUSION

## ELECTRICAL

## NPS MANAGEMENT POLICIES / DIRECTOR'S ORDERS

## LAWS

## CODES AND STANDARDS

- NFPA Codes and Standards
- NESC National Electrical Safety Code
- IEEE- Standards
- IESNA 9th Edition - Illuminating Engineers Society of North America
- EIA/TIA Standards 568 & 569

## QUALITY REQUIREMENTS

**Load Requirements:**
- NEC 2002
- Nameplate/Manufacturers Data
- 25-30% typical for future expansion

**Utilities:**
- Underground distribution as much as possible
- NPS prefers not to own & operate utilities

**Telecommunication:**
- EIA/TIA Standards, see above
- Cat 5 Cabling - (2) per 3/4" conduit; (1) Data, (1) Voice
- Telephone - Meet Local Phone Company Requirements

**Conduit:**
- Site specific, in general Schedule 40 PVC for underground
- Minimum branch circuit conduit size = 3/4"
- Provide conduit for telephone and data wiring (minimum size 3/4")
- See table below

**Power Wiring:**
- THWN / THHN
- Underground - THWN / XHHW
- Copper conductors

**Overcurrent Protection:**
- Breakers preferred for reset capability (sizes 15 amperes or greater)
- Fuses comply with NEC

**Equipment and Materials:**

- UL listed for application
- Conduit - see table below for environment and use

| ENVIRONMENT | RACEWAY | BOXES, ENCLOSURES, CABINETS |
|---|---|---|
| Dry locations, concealed | RMC, IMC, EMT, RNC, ENT[1], FMC, LFMC, LFNC, WW | SM, FS/FD, NM, NEMA 1 |
| Exposed, subject to damage | RMC, IMC | SM, FS/FD, NM, NEMA 1 |
| Exposed, not subject to damage | RMC, IMC, EMT, RNC, ENT[2], FMC, LFMC, LFNC | SM, FS/FD, NM, NEMA 1 |
| Wet locations, subject to damage | RMC[3], IMC[3], EMT[3], WW[7] | FS/FD, NEMA 4, 4X |
| Wet locations, not subject to damage | RMC[3], IMC[3], EMT[3], RNC, ENT[2], LFMC, LFNC, WW[7] | FS/FD, NM, NEMA 4, 4X |
| Outdoor locations, exposed to rain, sleet, wind-blown dust, and external icing | RMC[3], IMC[3], EMT[3], LFNC, WW[7] | FS/FD, NEMA 3, 3R, 3S |
| Submerged | RMC[3], IMC[3], RNC | NEMA 6, 6P |
| Embedded in concrete | RMC, IMC, EMT[4], RNC, ENT[4] | FS/FD |
| Under concrete slab | RMC, IMC, EMT[4] | |
| Underground, direct burial | RMC[3], IMC[3], EMT[3], RNC, ENT, LFNC | |
| Embedded burial | RMC, IMC, EMT[4], RNC, ENT[4], LFNC | |
| Industrial location, general | RMC, IMC, EMT, RNC, FMC, LFMC, WW | FS/FD, SM, NEMA 12, 12K |
| Subject to corrosion | RMC[3], IMC[3], EMT[3], RNC, LFMC | NEMA 4X, 11 |
| Subject to oil, vapors | RMC, IMC, LFMC | FS/FD, NEMA 13 |
| Hazardous Class I, Division 1[8] | RMC, IMC, FMC[8] | NEMA 7, 8 |
| Hazardous Class I, Division 2[8] | RMC, IMC, LFMC, FMC, WW[5] | FS/FD, NEMA 1, 7, 8, 12 |
| Hazardous Class II, Division 1[8] | RMC, IMC, LFMC, WW[5] | NEMA 9 |
| Hazardous Class II, Division 2[8] | RMC, IMC, LFMC, WW[5] | FS/FD, NEMA 1, 9, 12 |
| Hazardous Class III[8] | RMC, IMC, LFMC, WW[5] | FS/FD, NEMA 12 |

| TABLE LEGEND | TABLE NOTES |
|---|---|
| RMC - Rigid metal conduit | 1 — Finishes must provide barrier with |

| | |
|---|---|
| IMC - Intermediate metal conduit<br>EMT - Electrical metallic tubing<br>FMC - Flexible metal conduit<br>LFMC - Liquidtight flexible metal conduit<br>RNC - Rigid nonmetallic conduit<br>ENT - Electrical nonmetallic tubing<br>LFNC - Liquidtight flexible metal conduit<br>WW - Wireway<br>SM - Sheet metal box<br>FS/FD- Cast metal box<br>NM - Nonmetallic<br>NEMA - Re: NEMA 250 type classification | 15-minute rating.<br>2 — Building not more than 3 stories above grade.<br>3 — Corrosion protection required.<br>4 — With fittings for purpose.<br>5 — Enclosed and gasketed.<br>6 — Dusttight wireway only.<br>7 — Raintight wireway only.<br>8 — Suitable for hazardous location. |

## LIGHTING

### CODES AND STANDARDS

- NFPA Codes and Standards
- NESC National Electrical Safety Code
- IEEE- Standards
- IESNA 9th Edition – Illuminating Engineers Society of North America
- UL – Underwriter's Laboratory ( Product Safety )
- ASRAE/IESNA 90.1 / 1999 ( Energy Efficiency )
- International Dark-Sky Association Guidelines

### QUALITY REQUIREMENTS

**Some Criteria:**

- Horizontal illuminances (lighting intensities on horizontal surfaces)
- Vertical illuminances ( lighting intensities on vertical walls)
- Luminaire luminances (Light fixture brightness usually producing glare)
- Surface illuminances (Surface brightness addressing adaption effects)
- Life cycle (Issues and costs associated with manufacture, operation and disposal)
- Maintenance (Relamping and reballasting frequency and difficulty of either)
- Visual clarity

**Connected Lighting Loads:**

- 1.1 to 2.0 W/ s.f. depending on the space function –commercial facilities at the lower end and retail at the higher end.
- Reduce connected lighting loads with carefully planned task and ambient lighting. (Ambient lighting should be utilized as a strategic method for meeting code restrictions on energy use in all types of facilities). The most energy efficient lighting installations are based on a balance of three lighting layers- ambient, task and accent lighting. The expected goal is energy-effective lighting design.

**Fixtures and Components:**

- UL listed for application

**Lamps:**

- Low wattage with relatively high output lamps
- Comply with NEMA and UL

**Value:**

1) Lighting as a medium to an end – to visual comfort, user pleasure and satisfaction, and productivity over the long term.
2) Lighting design as a process. Specifically, it should be viewed as the process of integrating light into the fabric of architecture (both the architectural concept and the physical structure).

**OUTDOOR LIGHTING:**

1) Uplighting landscape and exterior architectural features is not acceptable. Dark night skies are a vital park resource and it is very important to protect the dark night skies and reduce light pollution. Light pollution is often caused by excessive or misdirected outdoor lighting.
2) Use lighting only when necessary (addressing safety and security issues). Timers are an effective way of maximizing light during the hours that is needed most.